THE DYNAMICS OF FOOD INSECURITY IN RURAL AMERICA:

ARE THERE REGIONAL DIFFERENCES?

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Introduction

Food insecurity exists "whenever the availability of nutritionally adequate and safe food or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain" (Anderson, 1990, p. 1560). Hunger, a narrower and more severe form of deprivation, is defined as "the painful or uneasy sensation caused by a lack of food" (Anderson, 1990, p. 1560).

Food insecurity and hunger have been assessed annually in nationally representative samples of the United States (US) population since 1995, as part of the Current Population Survey (CPS). For 2003, the most recent year for which national data are available, 11.2% of US households (12.6 million households) were food insecure, 7.7% were food insecure without hunger and 3.5% (3.9 million households) were food insecure with hunger. The prevalence of food insecurity among households with children was double the prevalence in households without children (16.7% vs. 8.2%). Non-metropolitan households had a prevalence of food insecurity that was 11.6% compared to 9.0% in metropolitan households outside central cities. By region of the country, food insecurity was most prevalent in the South (12.4%) and least prevalent in the Northeast (9.6%) (Nord, Andrews & Carlson, 2004)

The purpose of the research reported here is to examine regional differences in the changes across time (from 2000 through 2002) in the prevalence of food insecurity in a sample of poor rural families with children. Our particular focus is on the Northeast region of the US and whether it differs from other parts of the country. A second purpose of the research presented here is to identify factors associated with change in food insecurity status across time in this sample. For this objective, our particular interest is factors that constrain or facilitate leaving food insecurity.

Methods

1

Study Population and Sample

The initial sample for this longitudinal study included 422 rural low-income families from 24 counties in 14 states in the US who participated in a multi-state project, NC-223 "Rural Low-Income Families: Tracking Their Well-being in the Context of Welfare Reform." The longitudinal sample for the study reported here includes only families that completed the study by contributing data to all three waves of the annual data collection and families from states that were able to hold onto at least 50% of the families from their initial sample. This sample consisted of 193 families. The states participating in the initial sample are shown in Figure 1 and are from all regions of the country. We grouped Massachusetts, New Hampshire, and New York to form the Northeast category. We classified Kentucky, Louisiana, and Maryland as the South. The Midwest included Indiana, Michigan, Minnesota, Nebraska, and Ohio. The West included California, Oregon, and Wyoming. Three states in the initial sample (Louisiana, Michigan, and Indiana) lost more than half of their families by the last wave of data collection and were eliminated from the longitudinal analysis. Thus the longitudinal sample includes data from 11 states, three states from the East, Midwest and West and two states from the South.

Most of the counties included in the sample (80%) have Rural-Urban Continuum Codes (RUCC) of 6, 7, or 8 (Butler and Beale, 1994). Codes 6 and 7 indicate counties that are non-metropolitan with an urban population of 2,500 to 19,999. Code 8 counties are completely rural with no village of 2,500 or more people. Researchers in each state purposively selected one or two counties with these RUCC codes. In several states, counties with codes 6, 7, or 8 were not available for study. In California, two counties in the Central Valley with no nearby urban center of more than 10,000 persons were chosen. In New York and Massachusetts, the rural areas of one non-metropolitan county with a RUCC of 4, indicating an urban population of 20,000 to 50,000, were included.

In each county, families were recruited through programs that serve low-income families including the Food Stamp Program, Head Start, Supplemental Nutrition Program for Women, Infants, and Children (WIC), welfare-to-work programs, and migrant worker programs. In almost all counties, Cooperative Extension Service educators assisted with the recruiting. To be eligible for participation, families had to have annual household incomes at or below 200% of the federal poverty line and at least one child 12 years old or younger. Within each county, families were selected purposively to represent the diversity in the types of families with children who could be affected by welfare reform. A minimum of 15 families per county, if two counties per state were sampled, or 20 families, if only one county was included, were sought.

Design and Data Collection

The NC223 project is based on a post-positivist paradigm (Guba and Lincoln, 1994). This paradigm places special emphasis on collecting rich data in naturalistic settings and on soliciting participants' perspectives on their situation. In each year of the study, both indepth, qualitative and quantitative data were collected from the mother in the household by trained research assistants, using a semi-structured interview protocol. Interviews were conducted in English and Spanish. Interviews were conducted primarily in the participants' homes, but some were also conducted in a private place in the organizations from which participants were recruited. The questionnaire included items in these major areas: household size and composition; perceptions of the community where the participant lives; knowledge of community resources; employment and current work situation for self and partner; work history; transportation; child care; family of origin; family well-being; life skills; education; income, expenses and assistance received; food security; health of adults and children in the household; mental health (depression) of participant; parenting; and social support. Each interview lasted from one and one-half to two hours and was tape recorded.

The qualitative portion of the tape-recorded interviews was transcribed in each participating state according to an agreed upon protocol. All qualitative and quantitative data were sent to project personnel at Oregon State University where they were coded by trained and experienced personnel using agreed upon protocols and entered into WinMax (1998) and SPSS (version 10.1), respectively. Using the WinMax software, segments of the transcripts were coded electronically into the following categories: childcare, family issues, family of origin, housing, well-being, making ends meet, food security, current jobs, education and training, job history, transportation, welfare, health, mental health, social support (agencies), social support (family and friends), community, and the future.

Quantitative Measures and Variables for This Research

The outcome of interest in this study was food security status, a binomial categorical variable (food insecure vs. food secure). Food security status was assessed using the 18-item US Household Food Security Survey Module (Hamilton et al., 1997). Nord (2001) evaluated the data for scalability and recommended that standard scoring procedures were appropriate. Following the guidelines from USDA for scoring of responses, any participant giving an affirmative response to at least three questions on the Module was classified as food insecure (Bickel et al., 2000).

Based on Campbell's (1991) conceptual framework of food insecurity and Becker's (1993) human capital theory, several primary predictors of food insecurity were studied: chronic health conditions, having an illness or injury in the last year, depression, and food and financial life skills were studied. A chronic health conditions index was created using 16 of the 17 chronic health conditions used by Sturm and Wells (2001) in their research on obesity and health. The health problems available in the data and included in the index were: heart problems, high blood pressure, diabetes, cancer, digestive problems, liver problems, hepatitis, asthma,

4

kidney problems, eye or vision problems, back problems, chronic pain, permanent disability, reproductive problems, migraines/headaches, and arthritis. Subjects received one point for each chronic health condition.

The measure for symptoms of depression comes from the Feelings About How Things Are Going section of the questionnaire that included the Center for Epidemiological Studies Depression Scale, used widely in population surveys and known as the CES-D, (Radloff, 1977). This was expressed as a continuous variable derived by summing the scores from zero (rarely or none of the time) to three (most of the time) for the 20 items in the scale. Anyone with a score of 16 or higher is classified as at risk for clinical depression. The scale had a Cronbach's alpha of 0.89 in this sample.

The food and financial life skills index was created by summing four of the relevant items on the life skills assessment: ability to manage bills, ability to make a family budget, ability to stretch groceries to the end of the month, and ability to prepare a well balanced meal (Richards, 1998). Since the distribution of scores was skewed toward the higher end, this variable was transformed into a categorical variable. Those subjects who reported being skilled in two or less of the four areas were assigned to the low category. Those who possessed three of the skills were classified as having a medium level of skill, while those who were able to do all four of the skills were classified as highly skilled.

Formal program and social support were studied. Food Stamp Program participation was used to capture a family's participation in federal food assistance programs because nearly all families were theoretically eligible. It was expressed as a simple binomial categorical variable. If the family received food stamps at the time of the interview, it was considered a program participant. Perceived support for parenting was measured by the "Parenting Support Ladder" (Richards, 1998). Respondents were asked to rank themselves from 0 (low) to 6 (high)

on the ladder for a variety of statements such as, "Other parents for you to talk to?", "Someone to help you in an emergency?", and "Your overall satisfaction with the amount of support in your life." The scores for the six items were added to create a total score ranging from 0 to 36.

Data Analysis

Chi-square tests were run to examine if there were differences in the prevalence of food insecurity between the Northeast and the other three regions of the country, individually and combined in each year of data collection. Then again using chi-square analysis, the Northeast and the combined other regions were compared in terms of the proportion of the sample who escaped from food insecurity and fell into food insecurity over the three years. Finally, with all regions combined the factors associated with escaping from food insecurity over the three years were identified.

After the univariate analyses examining factors associated with escaping from food insecurity, we used a mixed methods approach to examine the associations between selected variables and food insecurity in the wave 1 sample for which complete data were available. We conducted multivariate regression analyses to see if the regional differences in food insecurity at this time point held when other predictors were considered. In addition, we explored how some of the human capital variables, particularly the health variables were associated with food insecurity.

We used a fairly common approach to building regression models, first screening variables of interest for their association to food insecurity and then including all that passed the screen in a model. We removed variables from multivariate models considering their significance and effect on the Nagelkerke R-square. Variables that were significant at the $p \leq 0.05$, greatly increased the R-square when included, and were part of a significant interaction, again at the $p \leq 0.05$ level, were retained. We examined all two-way interactions. All analyses

were performed on a personal computer using SPSS version 10.1 (SPSS Inc., Chicago, IL).

Once the best overall statistical model for food insecurity was identified, the sections of the

transcripts coded as food insecurity were examined to gain insight into how the number of

chronic health conditions might relate to food insecurity. Illustrative quotes and cases were

identified.

Results

Figure 2 shows the proportion of households in each region and at each time point who

were food insecure. The prevalence of food insecurity in families in the Northeast is clearly and

significantly higher ($p = 0.006$) than the prevalence in each of the other regions shown singly and

combined (Figure 2 and Table 1). By wave 2 (2001), the prevalence in each of the regions is

similar and ranges from 37 to 48%. In wave 3 (2002), the prevalence of food insecurity by

region again diverges with the South having a prevalence of 21.6% and the West and the

Northeast each having a prevalence around 40%. However in 2002, there were only 37 families

remaining in the sample in the South and only 8 were food insecure. Thus this prevalence is

questionable since it is based on a small sample.

As shown in Figures 3 and 4, there were no differences in the proportions of the sample

escaping food insecurity between the families in the Northeast and the families in the other

regions of the country. Slightly more than 40% of the families in both groups escaped food

insecurity over the three years of the study from 2000 through 2002. Likewise, there were no

differences in the proportion who fell from food security into food insecurity. From 2000

through 2002, 13.6% of the poor rural families with children in the Northeast fell from food

security into food insecurity and 12.1% of similar families in other parts of the country

experienced a similar fate.

Given the lack of differences across the regions in leaving food insecurity, we combined the data from all the regions to examine the factors associated with leaving food insecurity. Overall, forty-three percent of families escaped food insecurity over the three years of the study. Four factors were associated with leaving food insecurity at a level of $p < 0.10$ (See Table 2). Among the families with mothers who grew up in a family that for this study was defined as having a higher socioeconomic status (at least one parent graduated from high school and the family of origin did not receive welfare), 60% escaped food insecurity and 40% remained food insecure. Among those families with mothers who grew up in more disadvantaged circumstances, only 36.4% escaped food insecurity and 63.3% remained food insecure. The relationship between the socioeconomic status of the mothers' family of origin and escaping food insecurity was statistically significant ($p = 0.04$). Having some earned income over the previous year was also positively associated with leaving food insecurity ($p = 0.07$) in a graded fashion. Nearly 60% of those with $2,000 or more of annual earned income, escaped food insecurity compared to 26.3% of those with no earned income. The mothers in the families who left food insecurity had one fewer chronic health condition in an index of 16 conditions (2.8 vs. 1.8; $p = 0.02$). In addition, the families that left food insecurity perceived that they had higher levels of social support in their roles as parents (26.4 vs. 23.8; $p = 0.09$).

Quantitative Results from Analysis of Wave 1 Data

The descriptive information on the analytical sample, as well as the proportion that was food insecure, are shown in Table 3. Overall, 49.1% of the 316 households with complete data were food insecure. The prevalence in this sample is comparable to the prevalence in low-income non-metropolitan households with children who were receiving food stamps in the 1999 CPS sample (Nord, 2002). The majority of mothers in the households had one or more chronic health conditions with only 22.5% reporting that they had none. Households in which the

mother had more than the mean number of chronic health conditions were more likely to be food insecure than those with fewer health conditions (54.2% vs. 44.1%). The sample had a fairly high level of food and financial life skills, with 72.2% classified as having the highest skill level and only about 10% classified as having a low skill level. The proportion in each group who were food insecure differed dramatically, 42.1% vs. 83.3%, respectively. Overall, this sample had a high level of knowledge about community resources, and the proportion who were food insecure did not differ dramatically between those above and below the mean. Fifty-two percent of the sample participated in the Food Stamp Program at the time of the interview in 2000. Only 5% of the sample had household incomes greater than or equal to 185% of the federal poverty line, but nearly 65% of this group was food insecure. Food insecurity varied across the categories for the other variables as shown in Table 3.

Food and financial life skills and knowledge of community resources were each significantly protective against food insecurity ($p < 0.05$) in univariate models. Those with a high level of food and financial life skills were only one-eighth as likely to be food insecure compared to those with a low level of skills. Receiving food stamps was protective against food insecurity, but the relationship was not significant ($p = 0.11$). The number of chronic health conditions was significantly and positively associated with increased risk of food insecurity ($p < 0.05$).

When all predictors were considered in a single regression model, only food and financial life skills remained significant (Table 3). While the number of chronic health conditions was not a significant predictor of food insecurity, two other health-related variables emerged as significant: having difficulty paying for medical expenses and symptoms of depression. These results tend to indicate that it is the difficulty paying for the medical care needed for chronic health conditions and the impact of these conditions on mental health that are related to food

insecurity rather than the chronic health conditions themselves. This sample demonstrated a high prevalence of being at risk for clinical depression with 60.4% scoring above the mean which was in the range of clinical depression (score $\geq$ 16).

In this model, only one significant interaction was found. Being non-white and having higher education emerged as a protective factor against food insecurity. Additionally, owning a home was a significant protective factor against food insecurity. The first may be indicative of higher levels of human capital. The latter may be indicative of decreased diversion of financial resources away from food acquisition. Having difficulty paying for medical expenses, mentioned earlier, may also indicate a diversion of financial resources away from food acquisition. An unexpected finding was a significantly lower risk of food insecurity among families from the South, compared to families from the Northeast.

Qualitative Results from Wave 1 Analysis

As shown in the logistic regression analysis, poor health, measured as the number of chronic health conditions, was associated with food insecurity in the univariate analysis and other indicators of poor health were associated with food insecurity in the multivariate analysis. The different paths of this association are illustrated by the case descriptions from two food insecure households, Erin from Ohio and Bevin from New York.

Erin is a 34-year-old white, single mother of three children. She was widowed a few years ago and has not remarried. Her oldest two children are her late husband's, and the youngest is a 5-year-old boy by a different father. Erin has moved back to her hometown to be in a supportive environment where she is related to most of the people in the village.

Erin depends on her family for many things. Her sisters are helping to remodel her home, provide childcare, and help with transportation, food, money management and other necessities. Erin often depends on borrowed money from her family to buy food.

> *"...no more than a hundred, like, at a time. But usually about a hundred to*
>
> *go get groceries until the following week, or something like that."*

The family support does not go unnoticed. She feels the best thing about living where she does is that her family is close by.

Erin and her children had health problems this past year, causing financial strain because of lost time at work and medical bills. Her daughter, Mahala, is a diabetic and her younger son, Gray, has asthma. His asthma attacks cause her to take time off from work because he doesn't want anyone else taking care of him at those times. Erin also missed a week of work because of her own hospitalization, forcing her to seek out assistance to pay for her household bills. Besides the lost wages, Erin has the increased financial burden of medical costs. She sees an association between her difficulty paying for food and her medical bills.

> *"I : Well, did you have trouble paying for food?*
>
> *R : The food was, yeah. One thing that was hard. And then I had, like I*
>
> *said, doctor bills that I had to pay myself."*

Erin has a support system that she can depend on, but continues to struggle to meet her family's food needs when the economic pressures from health problems mount.

Erin, OH 116

Bevin and her children have recently experienced a tremendous upheaval in their lives, leaving them without a husband and a father, and with severe emotional and financial difficulties. After learning of her husband's sexual abuse of their children, Bevin moved her children from their upper middle class home and has been trying to put back the pieces of their lives ever since. Their life is riddled with utility shut-off notices, emotional trauma, and food insecurity. Fortunately, Bevin's grandmother helps to support her family with the necessities, including paying her mortgage and electricity and bringing food over when there is none.

Health issues plague the household of Bevin and her new partner, their young daughter, and her first two children. Bevin's psychological stress has affected the family financially and rendered her unable to work and to provide for her family.

" I: How about for you personally? How are things going?

R: [sighs] I had a nervous breakdown. Um, shortly after I became pregnant with my

daughter, and haven't been able to get back to work since. I worked for three months and

left the job on the verge of another nervous breakdown. And um, I'm in counseling, and

you know, I'm on medication."

In addition to her severe mental health issues, minor health problems also contribute to the financial strain and food insecurity of a family who is already struggling. Without a stable job that provides benefits, Bevin's partner's earnings fluctuate with his health.

" And, ah, the next paycheck came and Carlin was off for a day or two sick, and

um, you know, it wasn't enough again. And, for three months in a row I went to

the food pantry."

Bevin, NY 111

As illustrated in these cases, poor health of the mother and other family members results in medical bills that families pay out of their pockets, taking needed cash away from buying food. In addition, poor physical and mental health makes it difficult for women to work, further decreasing household income and the money available for food acquisition. Although the multivariate analysis uses cross-sectional data and this limits our ability to specify the direction

of causality, the qualitative data tend to support the idea that poor health leads to food insecurity in this sample. The causal inference is further strengthened by the finding from the longitudinal analysis showing that women in families that escaped from food insecurity had one fewer chronic health condition than those remaining food insecure over the three year study. Most of the previous research on the relationship between health and food insecurity in adults has tended to view food insecurity as a causative factor of poor health with lower levels of nutrient intake as intermediate factors (Olson & Holben, 2002).

Discussion

Despite a significant difference in the prevalence of food insecurity in 2000 between the Northeast and the rest of the country, particularly the difference between the Northeast and the South, we found no differences at subsequent time points.   Further we found no difference in the change in the prevalence of food insecurity across time in this sample of rural poor families with children. Two factors were identified which were significantly associated with escaping from food insecurity: the socioeconomic status of the mother in the family's family of origin and the number of chronic health condition the mother was experiencing at the beginning of the study. In addition, there was a trend for two additional factors to be associated with leaving food insecurity: having some earned income in the initial year of the study and feeling one had support in the parenting role. The mechanisms by which chronic health conditions lead to increased risk of food insecurity were demonstrated through a mixed methods approach combing multiple regression and qualitative data analysis on the wave 1 data. Poor health leads to an increased outlay of household money for medical care and also leads to a decrease in income to the household through an inability to work when sick. Both can lead to depression.

Conclusions and Policy Implications

Food insecurity was common in this sample of rural low- income families with children from 14 different states across the US. Nearly half of the families were food insecure using the USDA CPS food security survey and 57% persisted in food insecurity across the three years of the study. There were no regional differences in the dynamics of food insecurity across the three years of this study. Ill health, both physical and mental, is a major factor in the ecology of food insecurity in rural areas. The provision of health care at an affordable cost, for mental health problems and for physical disabilities, is central to promoting food security in rural areas of America. Coherent national and state-level health policies, including Medicaid, that recognize the unique nature of delivering comprehensive, quality health care in a rural setting are needed.

Acknowledgments

References

Anderson, S.A. ed. (1990). Core indicators of nutritional status for difficult-to-sample populations. *Journal of Nutrition,* 120, 1559-1600.

Becker, G.S. (1993). *Human capital a theoretical and empirical analysis with special reference to education,* (3rd ed.). Chicago, IL: University of Chicago Press.

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). *Guide to measuring household food security,* revised 200. Alexandria, VA:U.S. Department of Agriculture, Food and Nutrition Service.

Butler, M.A. & Beale, C.L. (1994). *Rural-urban continuum codes for metro and nonmetro counties.* Washington, D.C.: Agriculture and Rural Economy Division, Economic Research Service, United States Department of Agriculture.

Campbell, C.C. (1991). Food insecurity: A nutritional outcome or a predictor variable? *Journal of Nutrition,* 121, 408-415.

Guba, E.G. & Lincoln, Y.S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y.S. Lincoln (Ed.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage Publications, Inc.

Hamilton, W.L., Cook, J.T., Thompson, W.W., Buron, L.F., Frongillo, E.A. Jr., Olson, C.M., & Wehler, C.A. (1997). *Household food security in the United States in 1995. Summary report of the food security measurement project.* Washington, DC: Food and Consumer Service, United States Department of Agriculture.

Nord, M. (2002). The decline in food stamp use by rural low-income households: Less need or less access? In B.A. Weber, G.J. Duncan & L.A. Whitener (Ed.), *Rural Dimensions of Welfare Reform* (pp. 433-451). Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Nord, M. (2001). *Food security measurement in a survey of families with children in the north-central US.* Unpublished manuscript.

Nord, M., Andrews, M.A., & Carlson, S. (2004). *Household food insecurity in the United States, 2003.* Food Assistance and Nutrition Research Report No. 42. Washington, D.C.: Economic Research Service, United States Department of Agriculture.

Olson, C.M. & Holben, D. H. (2002). Position of the American Dietetic Association: Domestic food and nutrition security. *Journal of the American Dietetic Association*, 102 (12), 1840-1847.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385-301.

Richards, L.N. (1998). *One step at a time: A report on the outcomes of Oregon's 1996/1997 Even Start Programs prepared for Oregon Even Start Programs and Department of Community Colleges & Workforce Development.* Corvallis, OR: College of Home Economics and Education, Oregon State University.

Sturm, R. & Wells, K.B. (2001). Does obesity contribute as much to morbidity as poverty or smoking? *Public Health,* 115, 229-235.

Table 1. Proportion of Households Who Were Food Secure and Food Insecure by Northeast and

Other Regions Combined in Each Wave

	Food Secure, % (n)	Food Insecure, % (n)	p-value
Wave 1 (1999-2000)			0.006
Northeast	34.5 (29)	65.5 (55)	
Other regions	52.2 (107)	47.8 (98)	
Wave 2 (2001)			0.454
Northeast	54.5 (36)	45.5 (30)	
Other regions	59.9 (103)	40.1 (69)	
Wave 3 (2002)			0.234
Northeast	59.7 (37)	40.3 (25)	
Other regions	68.1 (109)	31.9 (51)	

Table 2. Variables Associated with Escaping Food Insecurity from Wave 1 (1999-2000) to Wave 3 (2002).

	Remained Food Insecure	Escaped Food Insecurity	p-value
Family of Origin SES	**% (n) compared by chi-square analysis**		0.04
High	40.0 (10)	60.0 (15)	
Low	63.6 (42)	36.4 (24)	
Earned Income			
> $2,000	41.4 (12)	58.6 (17)	0.07
$1,000 - $2,000	59.6 (34)	40.4 (23)	
None	73.7 (14)	26.3 (5)	
	Mean ± standard deviation		
Chronic Health Conditions	2.8 ± 2.6 (60)	1.8 ± 1.4 (45)	0.02
Support for Parenting	23.9 ± 8.3 (59)	26.4 ± 6.4 (43)	0.09

Table 3. Characteristics of the Sample, Proportion Food Insecure, and Risk (Odds Ratio) of Food

Insecurity[1] for the Contributors to and Protectors Against Food Insecurity (n = 316)

Risk Factors and Protectors	N (%) or Mean	% Food Insecure	Odds Ratio (95% CI)
Chronic Health Conditions Score [2]	1.98	>1.98, 54.2% < 1.98, 44.1%	1.12 (0.97, 1.30)
Food Life Skills			
Low	30 (9.5%)	83.3%	Reference
Medium	58 (18.4%)	58.6%	0.23 (0.06, 0.85) *
High	228 (72.2%)	42.1%	0.14 (0.04, 0.46)**
Knowledge of Community Resources [2]	77.25	>77.25, 47.7% < 77.25, 51.2%	0.70 (0.16, 3.07)
Participation in Food Stamp Program			
No	152 (48.1%)	44.1%	Reference
Yes	164 (51.9%)	53.7%	1.12 (0.61, 2.07)
Ethnicity			
Non-Hispanic White	221 (69.9%)	53.8%	Reference
Hispanic/Latino(a)	54 (17.1%)	48.1%	0.77 (0.25, 2.35)
African-American	23 (7.3%)	17.4%	0.44 (0.10, 2.06)
Other	18 (5.7%)	33.3%	0.41 (0.08, 2.14)
Education			
High School or Less	182 (57.6%)	55.0%	Reference
Education Beyond High School	134 (42.4%)	41.0%	0.99 (0.52, 1.87)
Ethnicity and Education Interaction			
White or Non-White with High School or Less	275 (87.0%)	53.8%	Reference
Non-White with Education Beyond High School	41 (13.0%)	17.1%	0.17 (0.04, 0.67)**
Rent or Own Housing			
Own	63 (19.9%)	33.3%	Reference
Rent	194 (61.4%)	57.2%	3.44 (1.57, 7.54)**
Other	59 (18.7%)	39.1%	1.64 (0.64, 4.16
Problems Paying for Medical Care			
No	228 (72.2%)	42.5%	Reference
Yes	88 (27.8%)	66.1%	3.20 (1.70, 6.05)**
Score on Depression Scale[2]	17.36	>17.36, 60.4% < 17.36, 40.1%	1.03 (1.01, 1.06)**
Percent of Poverty Line			
< 100%	202 (63.9%)	50.0%	Reference
≥ 100% and < 130%	58 (18.4%)	46.6%	1.15 (0.54, 2.46)
≥ 130% and < 185%	39 (12.3%)	41.0%	0.91 (0.37, 2.22)
≥ 185%	17 (5.4%)	64.7%	2.08 (0.59, 7.31)
Region			
East	68 (21.5%)	66.2%	Reference
South	64 (20.3%)	34.4%	0.28 (0.11, 0.71)**

Midwest	111 (35.1%)	46.0%	0.50 (0.24, 1.05)
West	73 (23.1%)	50.7%	0.63 (0.23, 1.75)

[1] Odds ratios determined from a single logistic regression model including all the variables listed. The model had a Nagelkerke R-Square = 0.38 and 75% of cases classified correctly. Variables with * are significant at $p \leq 0.05$ and those with ** at $p \leq 0.01$.

Figure 1. States Participating in the NC-223 Multi-State Research Project and Included in the Initial Sample
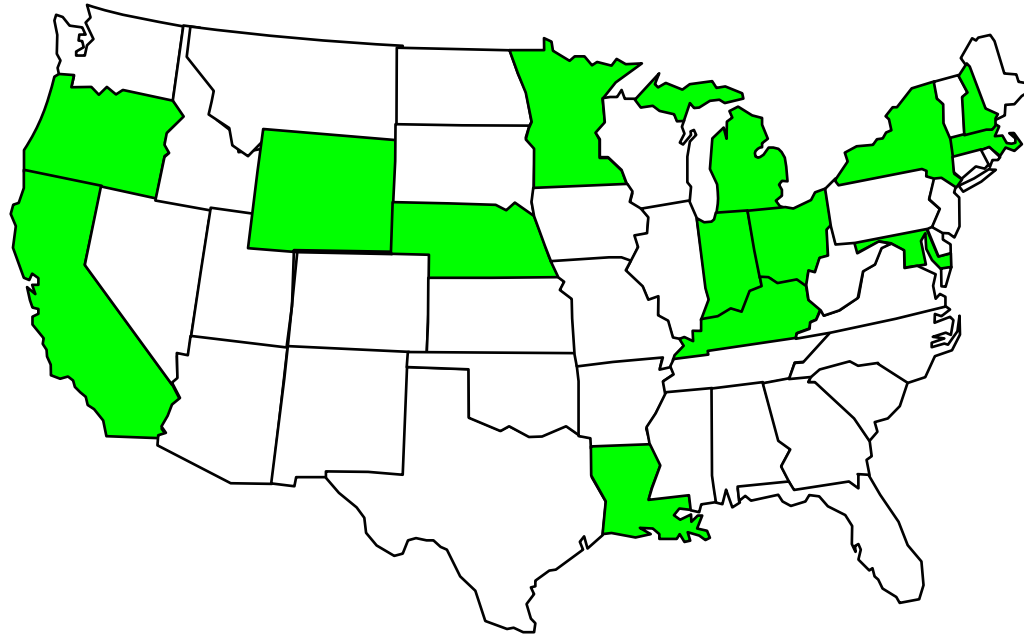
Figure 2. The Proportion of Households in Each Region Who Were Food Insecure at Each of the Three Waves of Data Collection
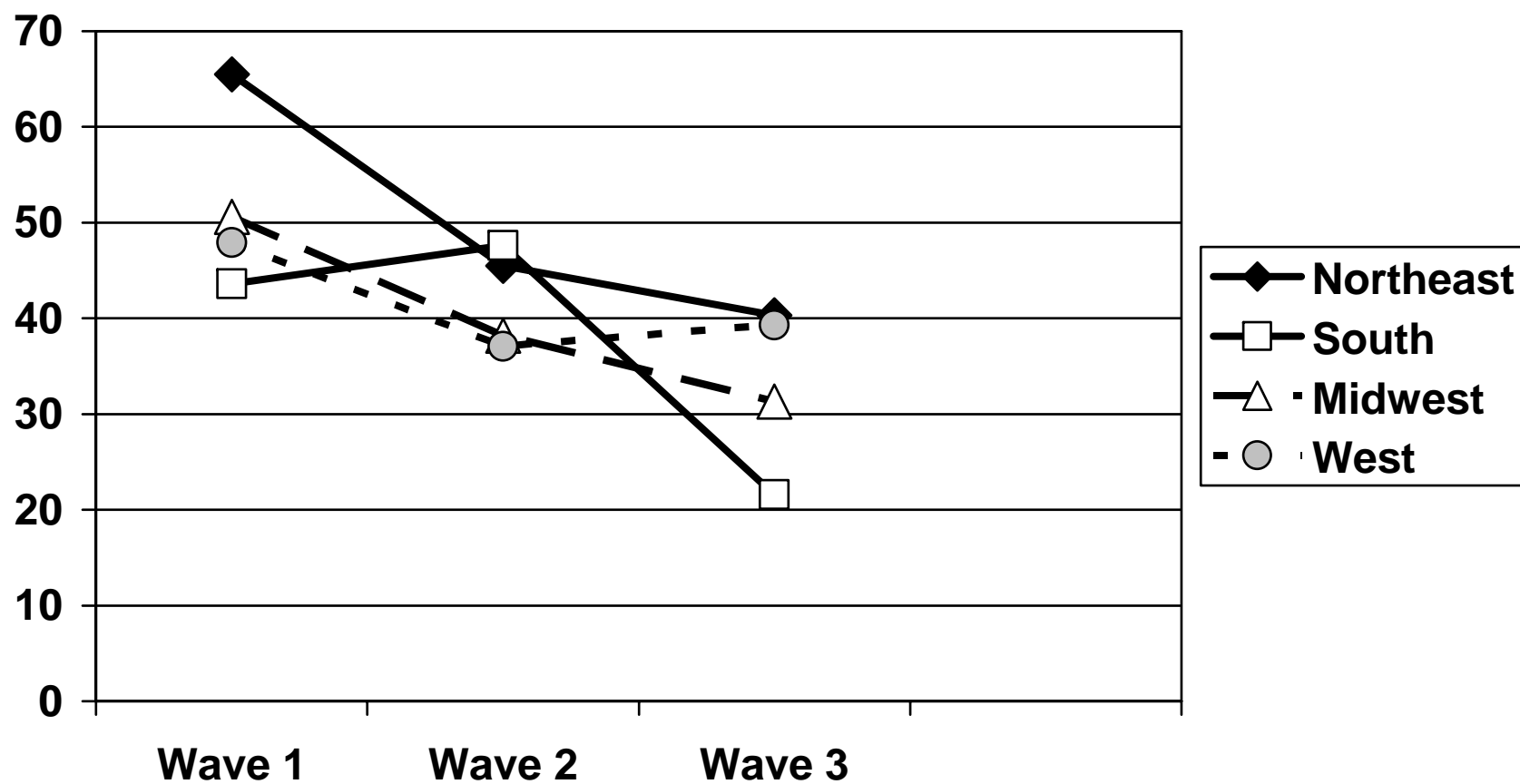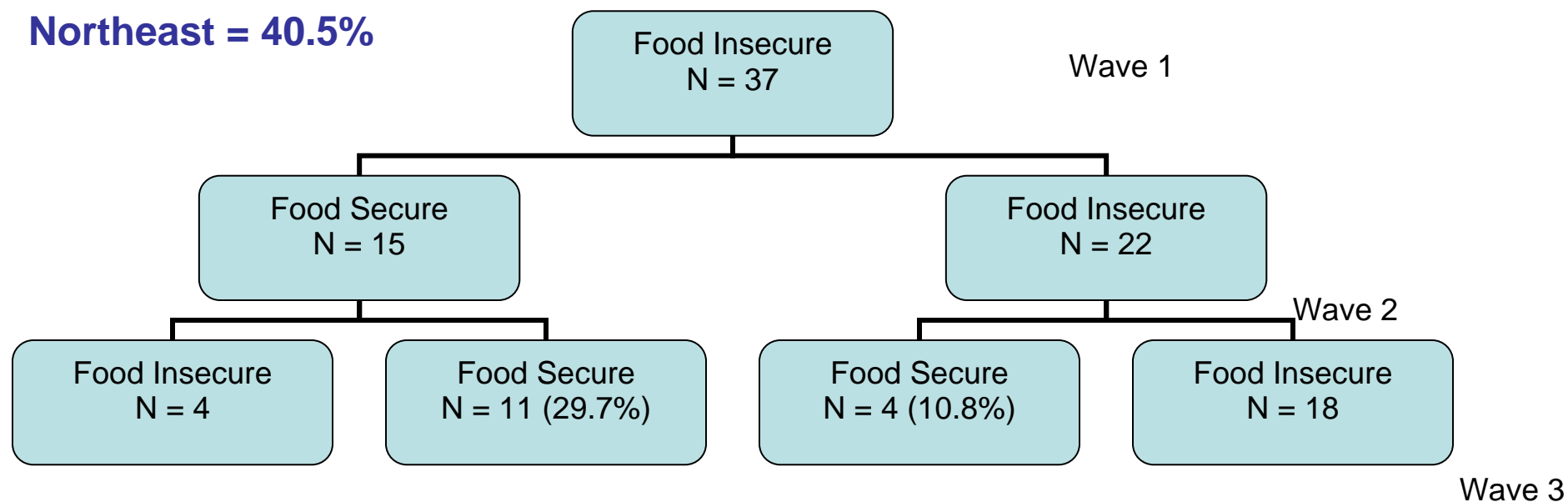
Figure 3. Proportion of Sample in Northeast and Other Regions Escaping Food Insecurity Across Three Years

Northeast = 40.5%

Food Insecure
N = 37

Wave 1

Food Secure
N = 15

Food Insecure
N = 22

Wave 2

Food Insecure
N = 4

Food Secure
N = 11 (29.7%)

Food Secure
N = 4 (10.8%)

Food Insecure
N = 18

Wave 3

Other Regions = 44.1%

Food Insecure
N = 68

Wave 1

Food Secure
N = 26

Food Insecure
N = 42

Wave 2

Food Insecure
N = 9

Food Secure
N = 17 (25.0%)

Food Secure
N = 13 (19.1%)
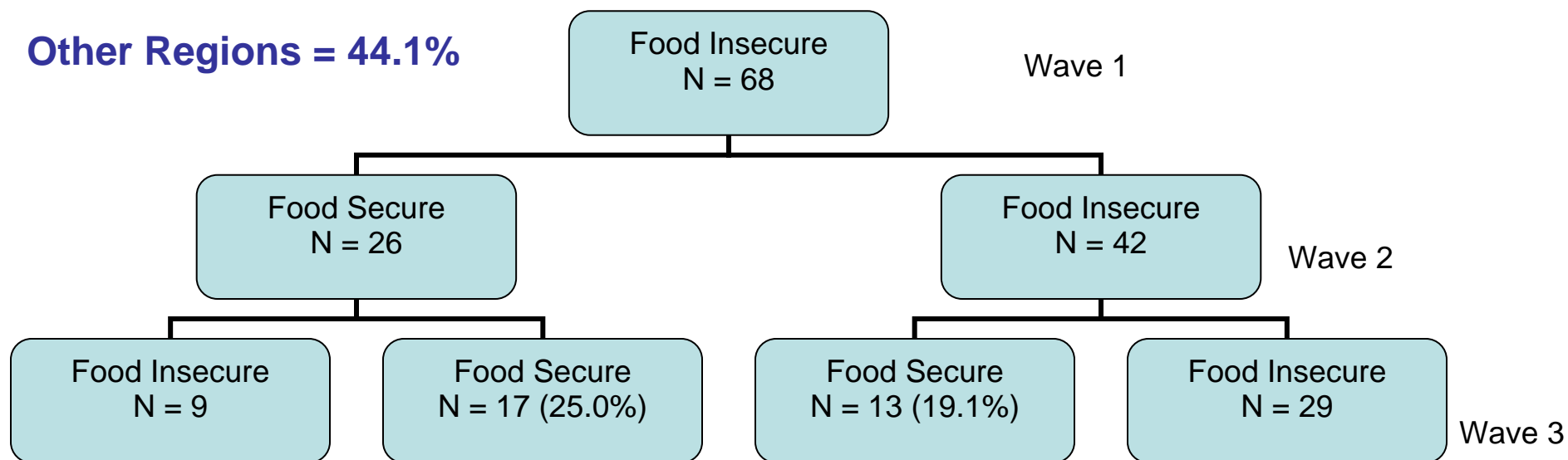
Food Insecure
N = 29

Wave 3

24

Figure 4. Proportion of Sample in the Northeast and Other Regions Falling From Food Security Over Three Years

Northeast = 13.6%

Food Secure
N = 22
Wave 1

Food Secure
N = 18

Food Insecure
N = 4
Wave 2

Food Insecure
N = 3 (13.6%)

Food Secure
N = 15

Food Secure
N = 4

Food Insecure
N = 0 (0%)
Wave 3

Other Regions = 12.1%

Food Secure
N = 66
Wave 1

Food Secure
N = 57

Food Insecure
N = 9
Wave 2

Food Insecure
N = 7 (10.6%)

Food Secure
N = 50

Food Secure
N = 8

Food Insecure
N = 1 (1.5%)
Wave 3